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Diversity of α and β in Two Fragments of Seasonal Deciduous Forest

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Abstract

The aim of this study was to evaluate the floristic and structural differences between two fragments of Seasonal Deciduous Forest in the São Francisco river, Minas Gerais. A total of 25 plots of 20×20 m in each fragment were allocated and all living individuals with Circumference at Breast Height (CAP) ≥ 15.7 cm were considered. The Shannon-Wienner indices and the Pielou equitability were equal among sampled areas. The Jaccard and Bray-Curtis similarities were 20.7% and 41%, respectively, indicating a high β diversity. Non-metric Multidimensional Scaling (NMDS) resulted in two floristic groups, distinguishing the flora of Presidente Juscelino and Paracatu. These results showed that the areas are floristically different but resemble each other in terms of diversity and structure.

Keywords: non-metric multidimensional scaling, phytosociology, São Francisco river.

1. INTRODUCTION AND OBJECTIVES

Seasonal Deciduous Forest (FEDs) are naturally fragmented throughout the neotropical region (Pennington et al., 2009). These fragments are considered remnants of a more extensive area that formed in the Pleistocene and that connected the Caatinga to the Argentine Chaco. It is believed that its distribution is related to the process of retraction of continuous areas that had their maximum expansion during the last Pleistocene glaciation when the climate was dry and cold (Prado & Gibs, 1993).

This vegetation usually occurs in soils of limestone origin, with a high presence of calcium and magnesium (Carvalho & Felfili, 2011; Silva & Scariot, 2003) and frequently associated with outcrops of limestone (Ribeiro & Walter, 2008). Consequently, these forests are subject to intense mineral exploration for farming and civil construction, besides being deforested by the selective cutting of their trees that present fine woods (Felfili, 2003).

Its floristic composition resembles that of adjacent vegetative formations and is closely related to climate, soil and terrain conditions (Pereira et al., 2011). It is a deciduous vegetation that can lose 50% to 90% of its leaves in the dry season (Nascimento et al., 2007; Ribeiro & Walter, 2008) and is therefore known as "dry forest". In Brazil, the FEDs can be found in the central region of the country, in northern and northeastern Minas Gerais (Rizzini, 1997) and within the Cerrado, Atlantic Forest and Caatinga domains (Espírito-Santo et al., 2008).

Given the importance and environmental vulnerability of this physiognomy, phytosociological studies are fundamental, widely used for the qualitative and quantitative diagnosis of vegetation formations. Additionally, they serve as a subsidy for the planning of environmental management actions and recovery of degraded areas (Chaves et al., 2013). Therefore, this work aims to detect floristic and structural patterns in the tree community of two fragments of Seasonal Deciduous Forest located in the São Francisco River Basin (BHRS), as well as to compare such patterns between these areas.

2. MATERIALS AND METHODS

2.1. Study area

The study was carried out in two fragments of Seasonal Deciduous Forest located in the municipalities of Paracatu (17° 3' 16.6" S and 46° 49' 23.5" W) and Presidente Juscelino (18° 38' 40" S and 44° 04' 57" W) in the state of Minas Gerais. Both are Legal Reserve areas of private properties located in the São Francisco River Basin.

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The fragment located in the municipality of Paracatu has an approximate area of 100 ha, with altitudes varying from 600 to 700 m. The climate of the region is Köppen type Aw, savannah climate, with a well-defined dry season, having temperature above 18° C in all months of the year and at least one month with total average rainfall below 60 mm (Álvares et al., 2013). The average annual rainfall is 1,305 mm (Climate-Data, 2018).

The fragment in Presidente Juscelino has altitudes between 600 and 890 m and approximately 150 ha area-wise. The region has mild temperate climate with hot and rainy summer and dry winter, which configures the Köppen type Cwa (Álvares et al., 2013). The area has a temperature above 18.9 °C in all months of the year, having at least one month with an average rainfall of 6 mm and an annual average of 1,139 mm (Climate-Data, 2018).

The soil of the two fragments presents a sloping area with outcropping of limestone rocks (belonging to the Bambuí group) and predominantly Littoral Neosols, the main type of soil found in the FED areas (Carvalho & Felfili, 2011). The prevailing vegetation is the FED. However, the Paracatu fragment is located in the core area of the Cerrado, while the one in Presidente Juscelino is in an ecotonal area, suffering floristic influence from the Atlantic Forest.

2.2. Vegetation sampling

In each of the fragments, 25 plots of 20 × 20 m were installed, totaling one hectare of area sampled. In Paracatu, the plots were randomly allocated following the protocol proposed by the Permanent Parcels Network in the Cerrado and Pantanal biomes (Felfili et al., 2005). In Presidente Juscelino, the plots were systematically distributed along five transects in the direction of greater slope of the fragment, with 50 m between transects and 20 m between plots.

In each of the fragments, all the living woody individuals that had a circumference ≥ 15.7 cm to 1.3 m of the soil (CAP) were sampled. The circumference was determined using a tape measure and the total height estimated with a graduated rod in meters. When it was not possible to determine the botanical identity of the individuals *in situ*, the botanical material was collected and later deposited in the Herbário Dendrológico Jeanine Felfili (HDJF) in the Universidade Federal dos Vales do Jequitinhonha e Mucuri (UFVJM). The species were classified into families according to the APG system, Angiosperm Phylogeny Group IV (APG, 2016). For the verification of spelling and nomenclature synonymies, the data banks of the Missouri Botanic Garden (MOBOT) and the International Plant Names Index (IPNI) were used.

2.3. Data analysis

The α diversity of the studied communities was evaluated using the Shannon-Wienner index (H') and the Pielou equitability (J') (Felfili & Rezende, 2003). In order to compare this diversity, the Hutcheson t-test ($p < 0.05$) was used with the aid of PAST 2.08 software (Hammer et al., 2001). For the analysis of β diversity, the Venn diagram was made using the Venny 2.1.0 software (Oliveros, 2015) as well as presence/absence and abundance matrices for the calculation of Jaccard similarity indices (Mueller-Dombois & Ellemberg, 1974) and Bray-Curtis (Brower & Zar, 1984), respectively.

The variation in floristic composition between fragments was evaluated through the Non-metric Multidimensional Scaling (NMDS), which was based on a binary matrix (presence/absence of species). The Jaccard index was chosen as a distance measure for the NMDS and the Monte Carlo test was used with 999 permutations to evaluate the significance of the ordering axes (McCune & Grace, 2002). This analysis was processed in the PCORD software, version 6.0 for Windows (McCune & Mefford, 2011).

For the structural analysis of the communities, the classical phytosociological parameters proposed by Mueller-Dombois & Ellenberg (1974) were calculated. In addition, in order to evaluate the size of the communities, the sampled individuals were distributed in diameter classes with increasing interval to compensate for the strong decrease of density in the larger size classes typical of the J-inverted distribution (Botrel et al., 2002).

3. 3. RESULTS AND DISCUSSION

3.1. Diversity α and β

Shannon diversity indices were 3.20 and 3.25 nats.ind^{-1} for the fragments of Paracatu and Presidente Juscelino, respectively. The Hutcheson t-test did not detect a significant difference between the H' values of the fragments ($p = 0.44$). These values are compatible with those found in FEDs throughout Minas Gerais, which varied between 2.59 nats. ind^{-1} and 3.47 nats. (Schaefer et al., 2008).

The Pielou equitability index (J') was 0.76 for both areas, which gives a strong ecological dominance of the communities, in which five species represented 52.9% (in Paracatu) and 48.5% (in Presidente Juscelino) of the total. The inequality in population size and high dominance of few soil-specialist species of fertile soils are common features of Cerrado Deciduous Forests (Cunha et al., 2013; Oliveira-Filho & Ratter, 2002).

The Venn diagram (Figure 1) showed a low percentage of species shared between the areas (23.4%). Regarding the exclusive species, 40 (36%) were identified in the Paracatu fragment and 45 (40.5%) species in Presidente Juscelino.

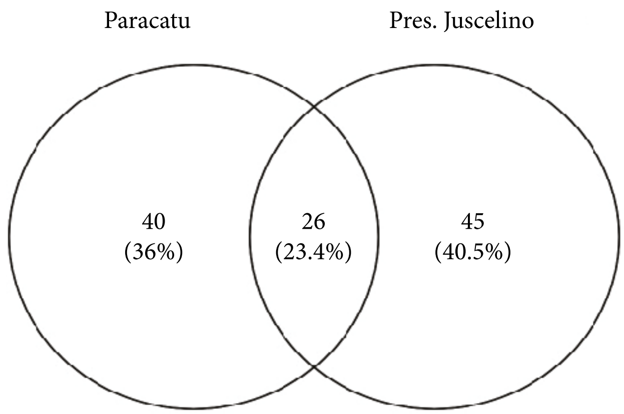

Figure 1. Venn diagram of the floristic composition of Seasonal Dry Forest fragments in Paracatu and Presidente Juscelino, MG, in São Francisco river.

The values found for the similarity index of Jaccard (20.7%) and Bray-Curtis (41%) are considered low by the literature (Lopes et al., 2009; Rosa et al., 2016). These indices vary from 0 to 1, with a similarity less than 0.5 considered low (Lopes et al., 2009). These results, together with the low number of species shared between the areas, show high β diversity of these forest formations.

In the NMDS ordination analysis the first two axes were significant ($p < 0.05$) by the Monte Carlo permutation test. The stress value was 15.14% ($p < 0.01$), which corresponds to an explained variance of 84.86%. The ordination showed a clear separation between the two fragments studied as a result of species composition, forming two distinct groups (Figure 2). This result reinforces the high β diversity among the fragments studied.

High diversity α and β are important for the conservation of the biological and functional diversity of ecosystems, especially in fragmented environments such as the FEDs. These reflect a high variety of niches ensuring greater species substitution and biological complementarity between habitats along gradients and at different spatial scales (Condit et al., 2002). According to Felfili & Felfili (2001) a high diversity β is considered determinant for the establishment of priority areas for conservation.

The floristic heterogeneity between the sampled fragments (β-diversity) may be related to the environmental characteristics (geographical distribution, edaphic factors, rockiness etc.) and to the vegetative matrix in which they are inserted (Gonzaga et al., 2013; 2017). The Paracatu fragment, located in the core area of the Cerrado, presented in its floristic composition species typical of this biome such as *Magonia pubenscens* A.St.-Hil., *Curatella americana* L., *Kielmeyera coriaceae* Mart. And Zucc., among others (Mendonça et al., 2008). The presence of *Cordia ochnaceae* DC, *Eugenia florida* DC, and *Syagrus romanzofiana* (Cham.) is frequently reported in studies of endemic species in the Atlantic Forest (Alves et al., 2015; Begnini et al., 2013; Donato & Morretes, 2009).

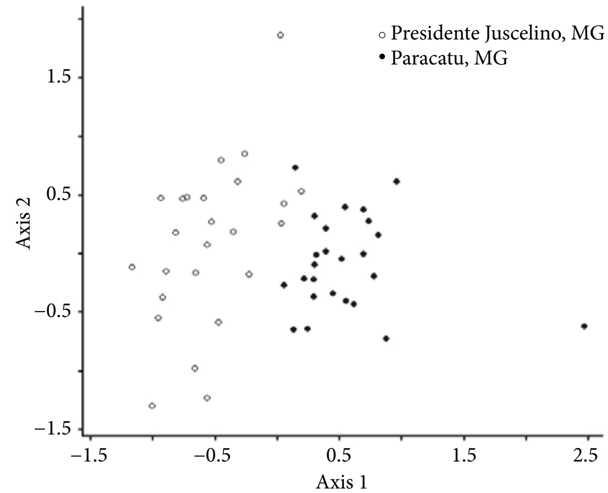

Figure 2. Non-metric Multidimensional Scaling (NMDS) ordering axes of the plots sampled in Seasonal Dry Forest fragments in Presidente Juscelino and Paracatu, MG, in São Francisco river.

3.2. Floristic composition and structure

In the Paracatu fragment, 1,000 individuals were sampled resulting in a basal area of 22.94 $m^2.h^{-1}$. These individuals were distributed in 66 species, 54 genera and 25 families. In Presidente Juscelino, 913 individuals were found, totaling 21.61 $m^2.h^{-1}$ of basal area, distributed in 71 species, 53 genera and 24 families (Table 1). Ten individuals, considering the two fragments, were excluded from the analyses because they were not identified at the species level.

Regarding floristic richness, Fabaceae was the most representative family in both areas, with 16 species in each municipality, followed by the family Malvaceae, with 5 and 6 species, in Paracatu and Presidente Juscelino, respectively. The Bignoniaceae family also excelled in both areas with 4 species in Paracatu and 5 species in Presidente Juscelino. In addition, Moraceae families (5) in Paracatu and Meliaceae (5) in Presidente Juscelino were among those with higher presence (Table 1). These families represented 45% of the total species sampled in each area.

Anadenanthera colubrina and *Myracrodruon urundeuva* had the highest VI (Value of Importance) in both fragments. In Paracatu, the species *A. colubrina*, *M. urundeuva*, *Aspidosperma pyrifolium*, *Ficus gomelleira* and *Sebastiania brasiliensis*, represented 44.6% of the VI found for the fragment. These values of importance are due to the high density of the species *A. colubrina* and *M. urundeuva*, *A. pyrifolium*, *S. brasiliensis* and the high dominance of *F. gomelleira*. In Presidente Juscelino, 44.1% of the VI was found in the species *A. colubrina*, *M. urundeuva*, *Machaerium acutifolium*, *Dilodendron bipinnatum*, *Deguelia costata*. All those species presented high density and the highest values of relative dominance.

Table 1. Phytosociological parameters of the fragments sampled in the municipalities of Paracatu and Presidente Juscelino. The tree species are arranged in alphabetical order of family.

FAMILIES	Paracatu, MG				Presidente Juscelino, MG			
Species	DR	FR	DoR	VI	DR	FR	DoR	VI
ANACARDIACEAE								
Astronium fraxinifolium Schott ex Spreng.	1.3	2.6	1.01	4.9	0.8	1.2	1.71	3.7
Cyrtocarpa caatingae J.D.Mitch. & Daly	–	–	–	–	0.1	0.3	0.14	0.6
Myracrodruon urundeuva Allemão	10.7	6.8	12.70	30.2	9.4	5.6	12.01	27.0
Schinopsis brasiliensis Engl.	–	–	–	–	0.2	0.3	1.10	1.6
ANNONACEAE								
Annona mucosa Jacq.	0.1	0.3	0.05	0.5	–	–	–	–
Annona neolaurifolia H.Rainer	–	–	–	–	1.4	1.2	0.89	3.6
Annona sericia Dun.	–	–	–	–	–	–	–	–
Annona sylvatica A.St.-Hil.	–	–	–	–	2.0	1.6	0.88	4.4
APOCYNACEAE								
Aspidosperma cuspa (Kunth) S.F.Blake ex Pittier	3.9	3.2	2.27	9.4	–	–	–	–
Aspidosperma pyrifolium Mart.	11.7	6.8	10.13	28.7	2.5	4.0	2.00	8.6
Aspidosperma subincanum Mart. ex A.DC.	–	–	–	–	0.2	0.3	0.10	0.6
ARALIACEAE								
Aralia warmingiana (Marchal) J. Wen	–	–	–	–	2.7	3.1	1.24	7.1
Schefflera macrocarpa (Cham. & Schltdl.) Frodin	–	–	–	–	0.1	0.3	1.36	1.8
Schefflera morototoni (Aubl.) Maguire. Steyerm. & Frodin	–	–	–	–	0.1	0.3	0.03	0.4
ARECACEAE								
Syagrus romanzoffiana (Cham.)	–	–	–	–	0.1	0.3	0.05	0.5
BIGNONIACEAE								
Fridericia bahiensis (Schauer ex. DC.) L.G. Lohmann	–	–	–	–	0.4	0.9	0.06	1.4
Handroanthus impetiginosus (Mart. ex DC.) Mattos	5.2	5.2	6.22	16.6	2.2	4.0	2.16	8.4
Handroanthus ochraceus (Cham.) Mattos	0.1	0.3	0.03	0.5	–	–	–	–
Handroanthus serratifolius (Vahl) S.O. Grose	–	–	–	–	0.1	0.3	0.01	0.4
Jacaranda brasiliana (Lam.) Pers.	0.6	1.3	0.23	2.1	–	–	–	–
Tabebuia roseoalba (Ridl.) Sandwith	0.1	0.3	0.01	0.4	2.6	3.1	1.23	7.0
Zeyheria tuberculosa (Vell.) Bureau	–	–	–	–	0.3	0.9	0.05	1.3
BORAGINACEAE								
Cordia glazioviana (Taub.) Gottschling & J.J. Mill.	–	–	–	–	0.3	0.6	0.32	1.3
Cordia ochnacea DC.	–	–	–	–	0.1	0.3	0.05	0.5

Table 1. Continued...

FAMILIES	Paracatu, MG				Presidente Juscelino, MG			
Species	DR	FR	DoR	VI	DR	FR	DoR	VI
BURSERACEAE								
Protium heptaphyllum (Aubl.) Marchand	0.2	0.3	0.06	0.6	–	–	–	–
Protium warmingianum Marchand	–	–	–	–	0.1	0.3	0.02	0.4
CANNABACEAE								
Celtisiguanaea (Jacq.) Sarg.	1.6	3.2	0.57	5.4	1.9	3.1	0.72	5.7
CELASTRACEAE								
Maytenus aquifolia Mart.	–	–	–	–	0.1	0.3	0.06	0.5
Maytenus robusta Reissek	0.1	0.3	0.02	0.4	0.2	0.6	0.03	0.9
Salacia crassifolia (Mart.) G. Don	–	–	–	–	0.1	0.3	0.03	0.4
CLUSIACEAE								
Kielmeyera coriacea Mart. & Zucc.	0.1	0.3	0.01	0.4	–	–	–	–
COMBRETACEAE								
Combretum duarteanum Cambess.	–	–	–	–	0.3	0.3	0.25	0.9
Combretum leprosum Mart.	–	–	–	–	0.1	0.3	0.03	0.5
DILLENIACEAE								
Curatella americana L.	0.1	0.3	0.02	0.4	–	–	–	–
EBENACEAE								
Diospyros coccolobifolia Mart. ex Miq.	0.9	1.3	0.29	2.5	–	–	–	–
ERYTHROXYLACEAE								
Erythroxylum deciduum A. St.-Hil.	1.0	2.3	0.20	3.5	–	–	–	–
Erythroxylum pelleterianum A. St.-Hil.	0.3	0.6	0.06	1.0	2.4	2.2	0.76	5.3
EUPHORBIACEAE								
Sapium glandulosum (L.) Morong	0.3	0.6	0.03	1.0	0.2	0.6	0.04	0.9
Sebastiania brasiliensis Spreng.	11.6	4.2	5.85	21.7	–	–	–	–
FABACEAE								
Albizia polycephala Benth.	0.1	0.3	0.01	0.4	–	–	–	–
Albizia polyphylla Benth.	0.1	0.3	0.04	0.5	–	–	–	–
Anadenanthera colubrina (Vell.) Brenan	13.3	7.5	11.27	32.0	19.3	7.2	29.95	56.4
Bauhinia catingae Harms	1.5	1.6	0.35	3.5	0.4	0.9	0.06	1.4
Chloroleucon dumosum (Benth.) G.P. Lewis	1.0	0.6	0.50	2.1	–	–	–	–
Copaifera langsdorffii Desf	0.2	0.3	0.13	0.7	–	–	–	–
FABACEAE								
Deguelia costata (Benth.) Az.-Tozzi	–	–	–	–	4.5	2.8	2.73	10.0
Dimorphandra mollis Benth.	0.1	0.3	0.03	0.4	–	–	–	–
Dipteryx alata Vogel	0.2	0.6	0.31	1.2	–	–	–	–
Diptychandra aurantiaca Tul.	0.1	0.3	0.02	0.4	–	–	–	–
Hymenaea courbaril L.	0.9	1.3	0.54	2.7	–	–	–	–
Machaerium acutifolium Vogel	0.1	0.6	0.02	0.8	10.7	3.7	8.34	22.8

Table 1. Continued...

FAMILIES	Paracatu, MG				Presidente Juscelino, MG			
Species	DR	FR	DoR	VI	DR	FR	DoR	VI
Machaerium brasiliense Vogel	3.6	2.9	1.00	7.5	1.4	0.9	0.46	2.8
Machaerium hirtum (Vell.) Stellfeld	1.2	1.6	1.51	4.3	0.4	1.2	0.13	1.8
Machaerium nyctitans (Vell.) Benth.	–	–	–	–	0.3	0.6	0.78	1.7
Machaerium opacum Vogel	–	–	–	–	0.1	0.3	0.47	0.9
Machaerium scleroxylon Tul.	0.4	1.3	0.07	1.8	1.9	5.3	1.31	8.5
Machaerium villosum Vogel	–	–	–	–	0.1	0.3	0.51	0.9
Platycyamus regnellii Benth.	–	–	–	–	0.1	0.3	0.14	0.6
*Platymiscium floribundum*Vogel	–	–	–	–	0.1	0.3	0.02	0.4
Platypodium elegans Vogel	0.4	0.6	0.96	2.0	2.2	2.2	1.07	5.4
Poecilanthe grandiflora Benth.	0.1	0.3	0.03	0.5	0.4	0.9	0.09	1.5
Senegalia tenuifolia (L.) Britton & Rose	–	–	–	–	2.3	2.8	0.42	5.5
Swartzia macrostachya Benth.	–	–	–	–	0.1	0.3	0.78	1.2
LECYTHIDACEAE								
Lecythis lanceolata Poir.	–	–	–	–	0.5	0.9	3.41	4.9
MALVACEAE								
Ceiba pubiflora (A. St.-Hil.) K. Schum.	–	–	–	–	0.1	0.3	0.01	0.4
Ceibaspeciosa (A. St.-Hil.) Ravenna	0.8	1.9	2.09	4.8	–	–	–	–
Eriotheca gracilipes (K. Schum.) A. Robyns	–	–	–	–	0.1	0.3	0.08	0.5
Guazuma ulmifolia Lam.	1.9	1.6	0.81	4.3	0.1	0.3	0.07	0.5
Helicteres brevispira A. St.-Hil.	–	–	–	–	0.2	0.6	0.11	0.9
Luehea candicans Mart. & Zucc.	–	–	–	–	0.2	0.6	0.94	1.8
Luehea paniculata Mart. & Zucc.	0.6	1.0	0.22	1.8	–	–	–	–
Pseudobombax tomentosum (Mart. & Zucc.) A. Robyns	1.4	1.3	2.10	4.8	–	–	–	–
Sterculia striata A. St.-Hill. & Naudin	1.6	3.2	3.00	7.8	0.3	0.3	0.43	1.1
MELIACEAE								
Trichilia catigua A. Juss.	–	–	–	–	4.5	4.0	0.97	9.5
Trichilia clausseni C. DC.	–	–	–	–	0.7	1.9	0.58	3.1
Trichilia elegans A. Juss.	0.6	1.0	0.54	2.1	–	–	–	–
Trichilia hirta L.	–	–	–	–	2.5	3.7	0.91	7.2
Trichilia pallens C. DC.	–	–	–	–	3.5	2.2	1.40	7.1
Trichilia pallida Sw.	–	–	–	–	0.2	0.6	0.27	1.1
MORACEAE								
Brosimum gaudichaudii Trécul	0.1	0.3	0.03	0.5	0.1	0.3	0.22	0.6
Ficus auriculata Lour.	0.1	0.3	0.01	0.4	–	–	–	–
Ficus gomelleira Kunth & C.D. Bouché	1.4	3.2	19.33	24.0	1.2	1.2	5.86	8.3
Ficus rupicola C.C. Berg & Carauta	1.0	1.9	1.08	4.0	–	–	–	–
Maclura tinctoria (L.) Steud.	0.3	1.0	0.07	1.3	0.1	0.3	0.06	0.5

Table 1. Continued...

FAMILIES	Paracatu, MG				Presidente Juscelino, MG			
Species	DR	FR	DoR	VI	DR	FR	DoR	VI
MYRTACEAE								
Campomanesia velutina (Cambess.) O. Berg	1.5	1.0	0.26	2.7	–	–	–	–
Eugenia dysenterica DC.	0.1	0.3	0.05	0.5	–	–	–	–
Eugenia florida DC.	–	–	–	–	0.7	1.6	0.12	2.3
Myrcia splendens (Sw.) DC.	0.1	0.3	0.07	0.5	–	–	–	–
Myrciaria floribunda (H. West ex Willd.) O. Berg	0.1	0.3	0.01	0.4	–	–	–	–
NYCTAGINACEAE								
Guapira areolata (Heimerl) Lundell	–	–	–	–	0.4	0.9	0.12	1.5
OPILIACEAE								
Agonandra brasiliensis Miers ex Benth. & Hook.	–	–	–	–	0.4	1.2	0.12	1.8
RUBIACEAE								
Alseis floribunda Schot.	–	–	–	–	0.2	0.6	0.02	0.9
Cordiera concolor (Cham.) Kuntze	–	–	–	–	0.3	0.9	0.09	1.4
Cordiera sessilis (Vell.) Kuntze	–	–	–	–	0.1	0.3	0.02	0.4
Coutarea hexandra (Jacq.) K.Schum.	1.2	1.6	0.29	3.1	2.2	1.9	1.02	5.1
Guettarda viburnoides Cham. &Schltdl.	0.1	0.3	0.06	0.5	–	–	–	–
Randia armata (Sw.) DC	0.1	0.3	0.03	0.5	–	–	–	–
RUTACEAE								
Zanthoxylum riedelianum Engl.	0.4	1.0	0.07	1.4	–	–	–	–
SALICACEAE								
Casearia mariquitensis Kunth	0.5	0.3	0.20	1.0	–	–	–	–
Casearia rupestris Eichler	2.1	1.9	0.66	4.7	0.3	0.9	0.30	1.6
Casearia sylvestris Sw.	0.3	0.3	0.09	0.7	–	–	–	–
SAPINDACEAE								
Allophylus sericeus (Cambess.) Radlk.	0.2	0.6	0.06	0.9	–	–	–	–
Cupania vernalis Cambess.	–	–	–	–	0.4	0.6	0.09	1.1
Dilodendron bipinnatum Radlk.	3.4	5.2	8.31	16.9	3.8	4.0	7.69	15.6
Magonia pubescens A. St.-Hil.	0.1	0.3	0.14	0.6	–	–	–	–
Talisia esculenta (A. St.-Hil.) Radlk.	–	–	–	–	0.5	0.6	0.44	1.6
SAPOTACEAE								
Chrysophyllum flexuosum Mart.	0.4	0.3	0.09	0.8	–	–	–	–
Chrysophyllum marginatum (Hook. & Arn.) Radlk.	4.9	2.6	3.14	10.6	–	–	–	–
Pouteria gardneri (Mart. & Miq.) Baehni	0.1	0.3	0.02	0.4	0.4	0.9	0.09	1.5
SOLANACEAE								
Solanum granulosoleprosum Dunal	0.4	0.6	0.11	1.2	–	–	–	–
URTICACEAE								
Urera baccifera (L.) Gaudich. ex Wedd.	0.1	0.3	0.03	0.5	–	–	–	–
VOCHYSIACEAE								
Qualea grandiflora Mart.	0.2	0.6	0.19	1.0	–	–	–	–

DR: relative density; FR: relative frequency; DoR: relative dominance; VI: value of importance.

A. colubrina and *M. urundeuva*, stand out among the most important species in surveys conducted in Brazilian deciduous forests (Carvalho & Felfili, 2011; Silva & Scariot, 2008; Siqueira et al., 2009). The high density of individuals of these species in dry forest environments is related to the preference for eutrophic soils, especially with high calcium contents (Scolforo et al., 2008). The distribution of these species in Latin America (Pennington et al., 2009) reinforces the Pleistocene arc theory, in which phenomena occurring in the Quaternary provided a continuous distribution of these taxa, being later isolated by disjunctions resulting from unfavorable climatic oscillations (Caetano & Naciri, 2011).

In both fragments, the diametrical distribution showed a higher concentration of individuals in the lower class of Diameter at Breast Height (DAP) (Figure 3). In this class, 54.1% of the individuals of Paracatu and 49.2% of those in Presidente Juscelino were concentrated. In the largest class, 2.3% and 3.7% (respective to Paracatu and Presidente Juscelino) of the total were sampled. This result demonstrates the high number of young individuals in both areas indicating a pattern of natural forests that are at the beginning of secondary succession (Botrel et al., 2002).

In general, the fragments were similar for structural characterization. Since the conservation status of an area reflects directly on its diversity and structure (Sabino et al., 2016; Santana et al., 2016) it is possible to see that the fragments are in a similar state of conservation. This result is consistent with the fact that both fragments are Legal Reserve areas of private properties and as such, have relatively restricted access and low degree of anthropic disturbance.

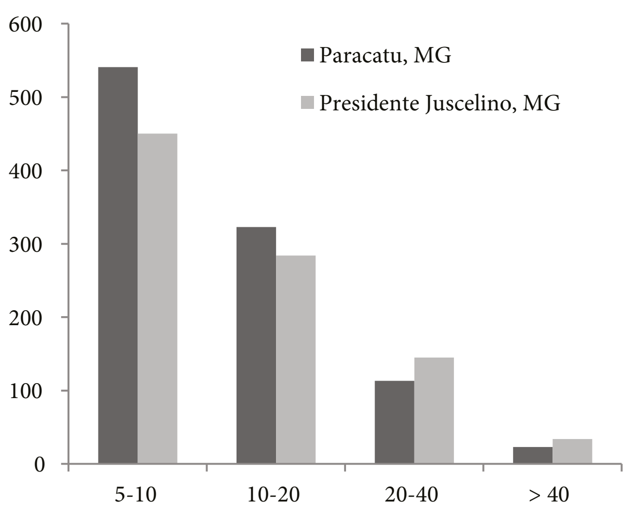

Figure 3. Diametrical distribution of individual sampled in Seasonal Dry Forest fragments, in São Francisco river.

4. CONCLUSION

The fragments differed floristically, possibly due to the set of physiographic aspects, including the different vegetative matrices in which they were inserted. This difference is reinforced by the high β diversity among the fragments, which highlights the importance of protecting both to guarantee the diversity and functional processes of their communities.

Structurally, the fragments were similar in relation to the values of basal area and diametric distribution of the community, indicating that these are in a similar state of conservation and ecological succession.

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REFERENCES

Álvares CA, Stape JL, Sentelhas PC, Moraes G, Leonardo J, Sparovek G. Köppen's climate classification map for Brazil. *Meteorologische Zeitschrift* 2013; 22(6): 711-728. 10.1127/0941-2948/2013/0507

Alves M, Oliveira RB, Teixeira SR, Guedes MLS, Roque NN. Levantamento florístico de um remanescente de Mata Atlântica no litoral norte do Estado da Bahia, Brasil. *Hoehnea* 2015; 42(3): 581-595. 10.1590/2236-8906-06/2015

Angiosperm Phylogeny Group – APG. An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG IV. *Botanical Journal of the Linnean Society* 2016; 181: 1-20.

Botrel RT, Oliveira-Filho AT, Rodrigues LA, Curi N. Influência do solo e topografia sobre as variações da composição florística e estrutura da comunidade arbóreo-arbustiva de uma floresta estacional semidecidual em Ingaí, MG. *Revista Brasileira de Botânica* 2002; 25(2): 195-213. 10.1590/S0100-84042002000200008

Brower JE, Zar JH. *Field e laboratory methods for general ecology*. Duduque: W. C. Brown Publishers; 1984.

Brower JE, Zar JH, Van Ende CN. *Field and laboratory methods for general ecology*. 4th ed. Boston: WCB McGraw-Hill; 1998.

Caetano S, Naciri Y. The biogeography of seasonally dry tropical forests in South America. In: Dirzo R, Young H, Mooney H, Ceballos G, editors. *Seasonally dry tropical forests*. London: Ecology and Conservation Island Press; 2011.

Carvalho FA, Felfili JM. Aplicação da diversidade alfa e beta para definição de áreas prioritárias para conservação: uma análise das florestas deciduais sobre afloramentos calcários no Vale do Paranã. *Biosciense Journal* 2011; 27(5): 830-838.

Chaves ADCG, Sousa RMS, Santos JO, Albuquerque AF, Maracajá PB. A importância dos levantamentos florístico e fitossociológico para a conservação e preservação das florestas. *Agropecuária Científica no Semiárido* 2013; 9(2): 43-48. 10.30969/acsa.v9i2.449

Climate-Data. *Clima* [Internet]. 2018 [cited 2018 Mar. 16]. Available from: https://bit.ly/36iYtN3

Condit R, Pitman N, Leigh EG, Chave J, Terborgh, J, Foster B et al. Beta-diversity in tropical forest trees. *Science* 2002; 295(5555): 666-669. 10.1126/science.1066854

Cunha MCL, Silva MC Jr, Baltazar LR. Fitossociologia do estrato lenhoso de uma floresta estacional semidecidual montana na Paraíba, Brasil. *Cerne* 2013; 19(2): 271-280. 10.1590/S0104-77602013000200011

Donato AM, Morretes BL. Anatomia foliar de Eugenia florida DC. (Myrtaceae). *Revista Brasileira de Farmacognosia* 2009; 19(3): 759-770. 10.1590/S0102-695X2009000500019

Espírito-Santo MRM, Fagundes M, Nunes YRF, Fernandes GW, Azofeifa GAS, Quesada M. Bases para a conservação e uso sustentável das florestas estacionais deciduais brasileiras: a necessidade de estudos multidisciplinares. *Unimontes Científica* 2008; 8(1): 13-22.

Felfili JM. Fragmentos de Florestas Estacionais do Brasil Central: diagnóstico e proposta de corredores ecológicos. In: Costa RB, editor. *Fragmentação florestal e alternativas de desenvolvimento rural na região Centro-Oeste*. Campo Grande: Universidade Católica Dom Bosco; 2003.

Felfili JM, Carvalho FA, Haidar RF. *Manual para o monitoramento de parcelas permanentes nos biomas Cerrado e Pantanal*. Brasília: Universidade de Brasília; 2005.

Felfili MC, Felfili JM. Diversidade alfa e beta no cerrado sensu strictu da Chapada Pratinha, Brasil. *Acta Botanica Brasilica* 2001; 15(2): 243-254. 10.1590/S0102-33062001000200010

Felfili JM, Rezende RP. *Conceitos e métodos em fitossociologia: comunicações técnicas florestais*. Brasília: Universidade de Brasília; 2003.

Felker RM et al. Caracterização florística e estrutural de um fragmento florestal na região central do Rio Grande do Sul. *Nativa Sino* 2018; 6(1): 73-78.

Gauch HG. *Multivariate analysis in community ecology*. Cambridge: Cambridge University Press: 1982.

Gonzaga APD, Machado ELM, Felfili JM, Pinto JRR. Brazilian Decidual Tropical Forest enclaves: floristic, structural and environmental variations. *Brazilian Journal of Botany* 2017; 40(2): 417-426. 10.1007/s40415-016-0346-z

Gonzaga APD, Pinto JRR, Machado ELM. Similaridade florística entre estratos da vegetação em quatro Florestas Estacionais Deciduais na bacia do Rio São Francisco. *Rodriguésia* 2013; 64(1): 11-19.

Gotelli AND, Colwell RK. Quantifying biodiversity: procedures and pitfalls in the measurement and comparison of species richness. *Ecology Letters* 2001; 4(4): 379-391. 10.1046/j.1461-0248.2001. 00230.x

Guedes RS, Zanella FCV, Costa JEV Jr, Santana GM, Silva JA. Caracterização florístico-fitossociológica do componente lenhoso de um trecho de Caatinga no semiárido paraibano. *Revista Caatinga* 2012; 25(2): 99-108.

Hammer O, Harper DAT, Ryan PD. PAST: Paleontological Statistics Software Package for Education and Data Analysis. *Palaeontologia Electronica* 2001; 4(1): 1-9.

Lopes SF, Vale VS, Schiavini I. Efeito de queimadas sobre a estrutura e composição da comunidade vegetal lenhosa do cerrado sentido restrito em caldas novas, GO. *Revista* Árvore 2009; 33(4): 695-704. 10.1590/S0100-67622009000400012

McCune BJ, Grace JB. *Analysis of Ecological Communities*. Oregon: MJM; 2002.

McCune BJ, Mefford MJ. *PC-ORD: multivariate analysis of Ecological Data*. Version 6.0. Oregon: MJM; 2011.

Mendonça RC, Felfili JM, Walter BMT, Silva MC Jr, Filgueiras TS, Nogueira PE et al. Flora vascular do bioma Cerrado: checklist com 12.356 espécies. Pp. 423-1279. In: Sano SM, Almeida SP, Ribeiro JF, editors. *Cerrado: ecologia e flora*. v. 2. Brasília: Embrapa Informação e Tecnologia; 2008.

Miles L, Newton AC, Fries RS, Ravilious C, May I, Blyth S et al. A global overview of the conservation status of tropical dry forests. *Journal of Biogeography* 2006; 33: 491-505. 10.1111/j.1365-2699.2005.01424.x

Morellato B, Silva RR, Castellani FT. Fenologia reprodutiva de Syagrus romanzoffiana (Cham.) Glassman (Arecaceae) em Floresta Atlântica no sul do Brasil. *Biotemas* 2013; 26(4): 53-60. 10.5007/2175-7925.2013v26n4p53

Mueller-Dombois D, Ellenberg H. *Aims and methods of vegetation ecology*. New York: John Wiley & Sons; 1974.

Nascimento RT, Felfili JM, Fagg CW. Estimativa da Abertura do dossel em duas florestas estacionais em afloramentos calcários no Brasil central com fotografias hemisféricas. *Revista Árvore* 2007; 31(1): 167-176. 10.1590/S0100-67622007000100019

Oliveira-Filho AT, Ratter JA. Vegetation physiognomies and wood flora of the bioma Cerrado. In: Oliveira PS, Marquis RJ, editors. *The Cerrados of Brazil: ecology and natural history of a neotropical Savanna*. New York: Columbia University Press; 2002.

Oliveros JC. *Venny: an interactive tool for comparing lists with Venn's diagrams* [Internet]. 2015 [cited 2020 May 18]. Available from: https://bit.ly/2ZJOWNU

Pennington RT, Lavin M, Oliveira-Filho A. Woody plant diversity, evolution, and ecology in the tropics: perspectives from Seasonally Dry Tropical Forests. *Annual Review of Ecology, Evolution, and Systematics* 2009; 40: 43-57. 10.1146/annurev.ecolsys.110308.120327

Pereira BAS, Venturoli F, Carvalho FA. Florestas estacionais no cerrado: uma visão geral. *Pesquisa Agropecuária Tropical* 2011; 41(3): 446-455. 10.5216/pat.v41i3.12666

Prado DE, Gibbs PE. Patterns of species distributions in the dry seasonal forests of South America. *Annals of the Missouri Botanical Garden* 1993; 8(4): 902-927. 10.2307/2399937

Ribeiro JF, Walter BMT. As Principais Fitofisionomias de Cerrado. In: Sano SM, Almeida SP, Ribeiro JF, editors. *Cerrado: ecologia e flora*. Brasília: Embrapa Informação Tecnológica; 2008.

Rizzini CT. *Tratado de Fitogeografia do Brasil: aspectos ecológicos, sociológicos e florísticos*. 2nd ed. Rio de Janeiro: Âmbito Cultural Edições; 1997.

Rosa AD, Silva AC, Higuchi P, Marcon AK, Missio FDF, Bento MA et al. Natural regeneration of tree species in a cloud forest in Santa Catarina, Brazil. *Revista* Árvore 2016; 40(6): 1073-1082. 10.1590/0100-67622016000600013

Sabino FGDS, Cunha MDCL, Santana GM. Vegetation Structure in Two Anthropic Fragments of Caatinga in Paraiba State, Brazil. *Floresta e Ambiente* 2016; 23(4): 487-497. 10.1590/2179-8087.017315

Santana JAS, Santana JAS Jr., Barreto WS, Ferreira ATPS. Estrutura e distribuição espacial da vegetação da Caatinga na Estação Ecológica do Seridó, RN. *Pesquisa Florestal Brasileira* 2016; 36(88): 355-361. 10.4336/2016.pfb.36.88.1002

Scolforo JRS, Machado ELM, Silva CPC, Mello JM, Oliveira-Filho AT, Andrade IS et al. Definição de Grupos Fisionômicos na Floresta Estacional Decidual. In: Scolforo JRS, Mello JM, Carvalho LMT, editors. *Inventário Florestal de Minas Gerais: Floresta Estacional Decidual: florística, estrutura, diversidade, similaridade, distribuição diamétrica e de altura, volumetria, tendências de crescimento e áreas aptas para manejo florestal*. v. 1. Lavras: Editora UFLA; 2008. p. 29-64.

Silva LA, Scariot A. Composição e estrutura da comunidade arbórea de uma floresta estacional decidual sobre afloramento calcário (Fazenda São José, São Domingos-GO, Bacia do Paranã). *Acta Botanica Brasilica* 2003; 17: 307-326. 10.1590/S0102-33062003000200012

Siqueira AS, Araújo GM, Schiavini I. Estrutura do componente arbóreo e características edáficas de dois fragmentos de floresta estacional decidual no vale do rio Araguari, MG, Brasil. *Acta Botanica Brasilica* 2009; 23: 10-12. 10.1590/S0102-33062009000100003